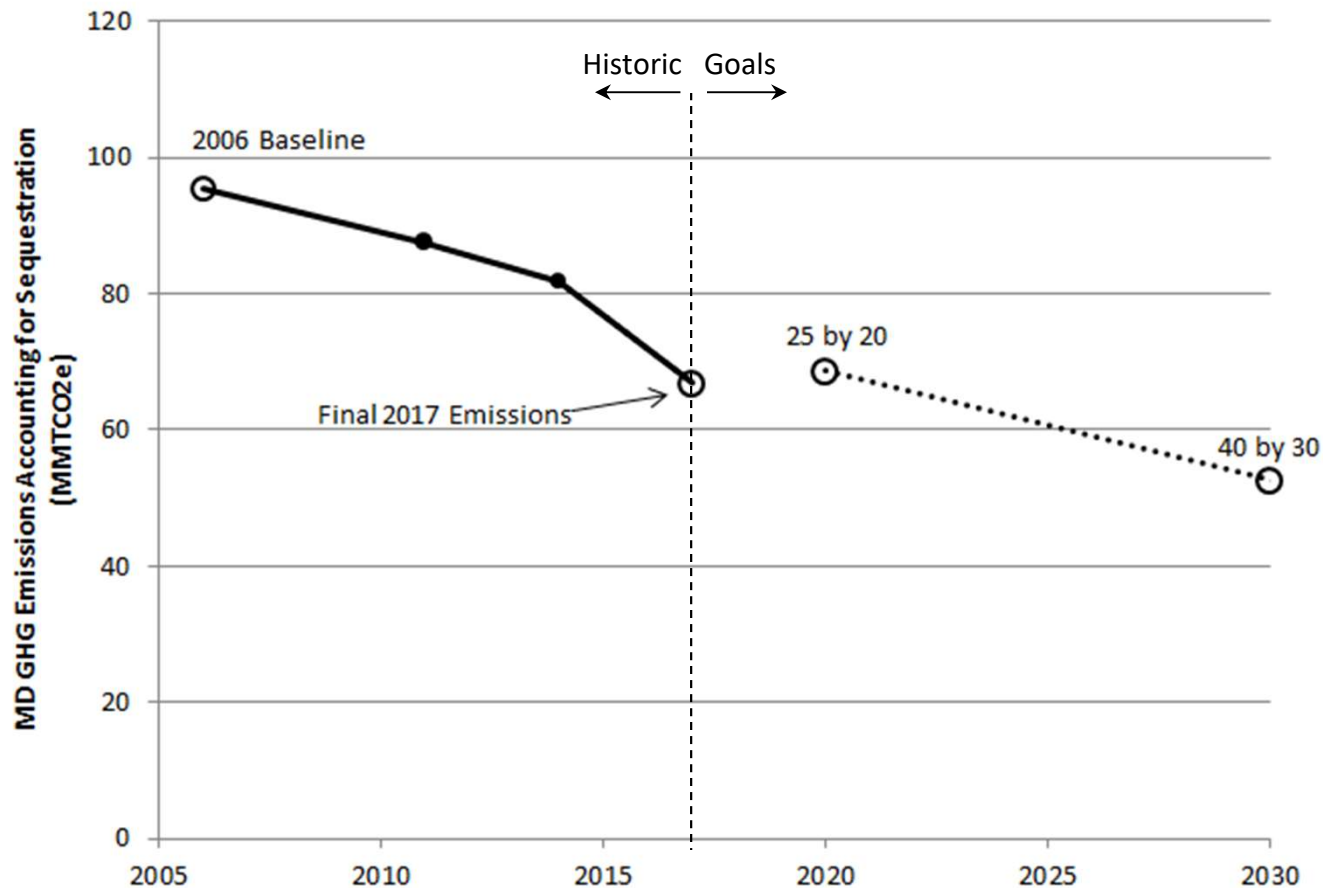# 2030 GGRA Planning Analysis Update

Mitigation Working Group Meeting
January 19, 2021

The Greenhouse Gas Reduction Act

Maryland Law ("GGRA"): Reduce GHGs 25% by 2020 and 40% by 2030

Maryland greenhouse gas emissions, accounting for sequestration. Please note favorable weather drove additional reductions in 2017.
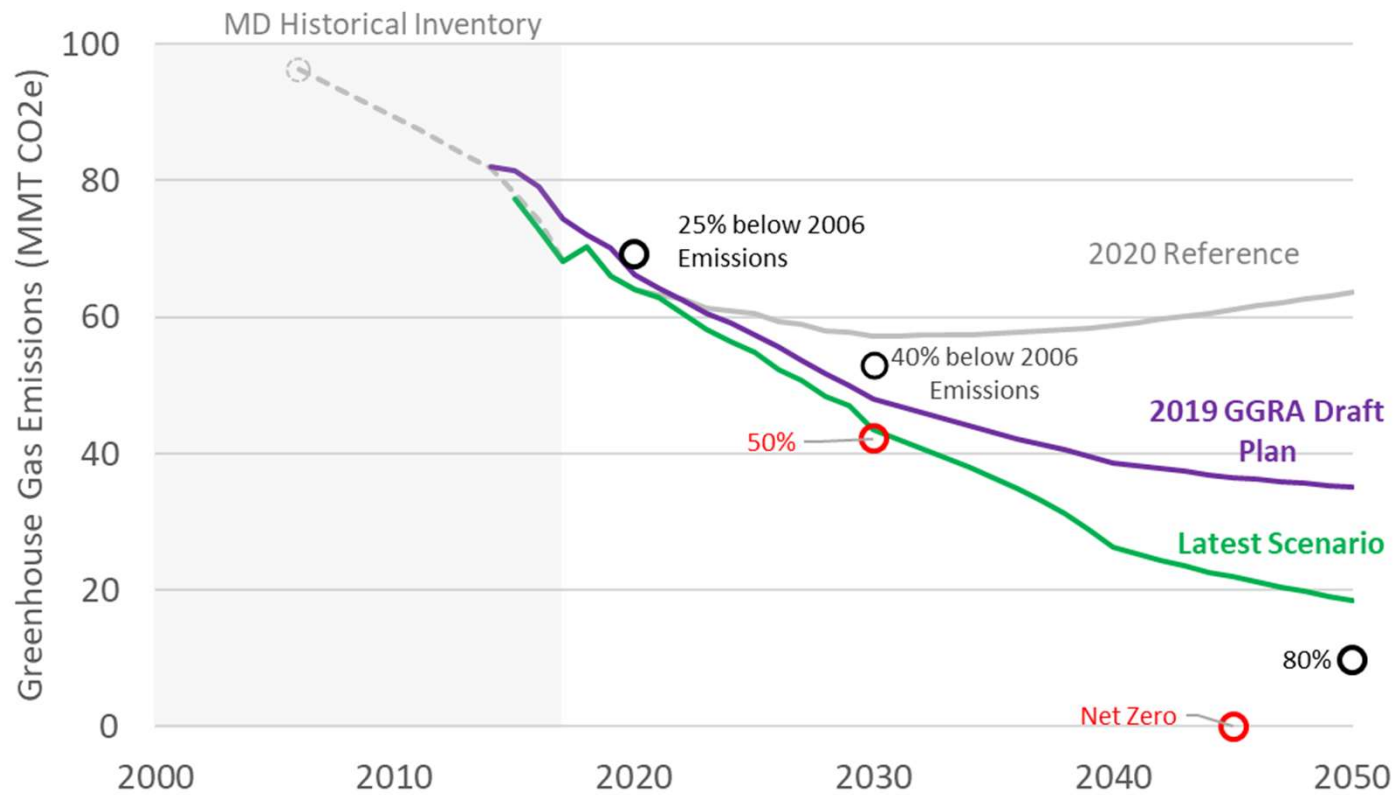
MD GHG Emissions Breakdown (2017)

E3's PATHWAYS GHG model is calibrated to the 2017 inventory, plus electricity and building data through 2019.

Agency Scenario

The GGRA requires MDE to develop a plan to meet the GHG goals. That plan draws upon existing programs across all levels of government, and new state programs.
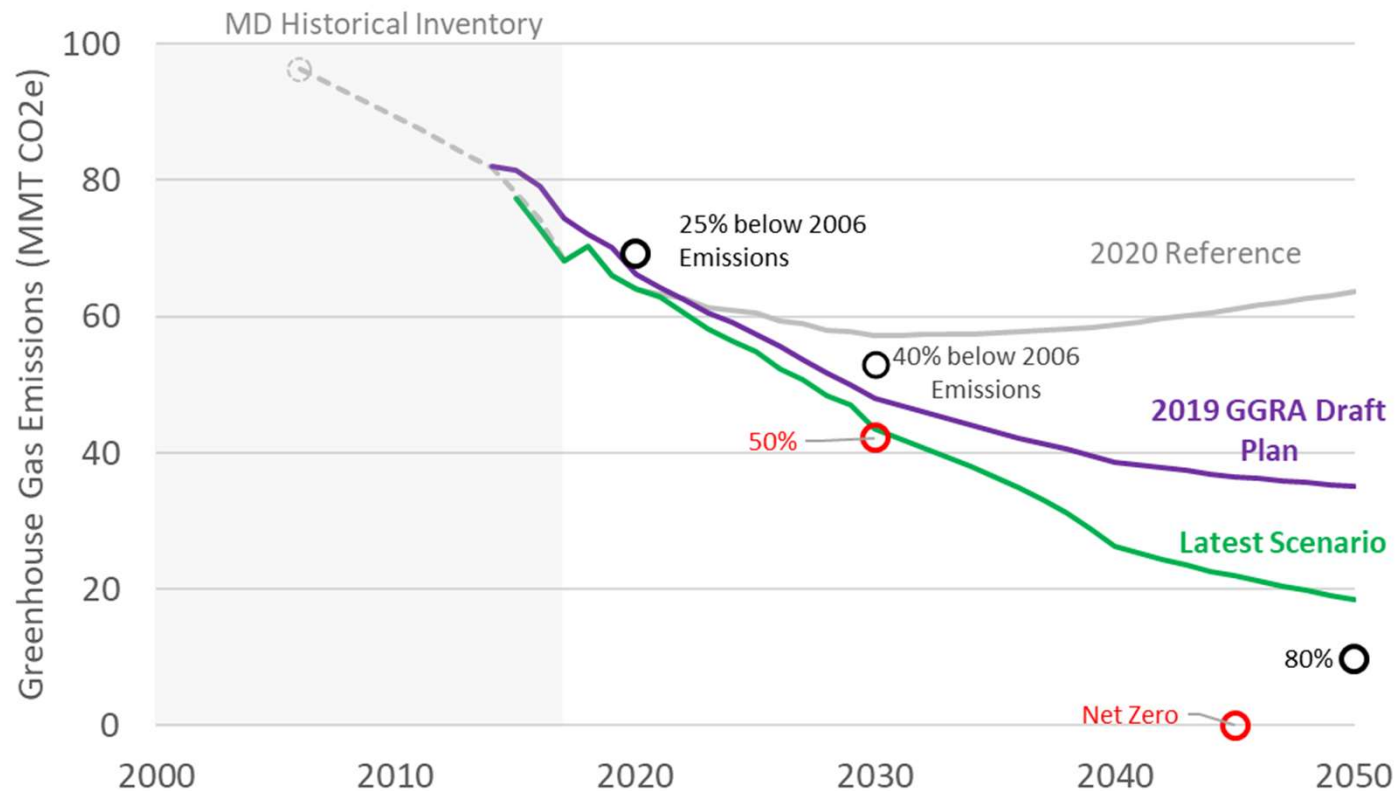

Maryland greenhouse gas emissions, accounting for sequestration. Projections from Draft Plan and Agency Scenario.

Agency Scenario

The agency scenario reduces GHGs substantially more than the 40-by-30 requirement, and nearly achieves 50-by-30 (~1.4MMT short).
Additional Federal action may make up the difference.

Maryland greenhouse gas emissions, accounting for sequestration. Projections from Draft Plan and 2030 GGRA Plan.

Major Mitigation Programs
(New Since 2019 Draft Plan)

Electricity Supply
Renewable Portfolio Standard (current)
Clean and Renewable Energy Standard (updated)
Regional Greenhouse Gas Initiative (RGGI) Long term 100% Clean Electricity
Expanded Net Metering (REDS Rpt)
SMART-POWER Offshore Wind Partnership

Transportation
Medium & Heavy Duty ZEV MOU
Greater telework post-COVID
State Fleet Innovation Plan
Public Transit & other infrastructure
Electric Vehicles: Clean Cars & ZEV Mandate
50% ZEV Transit Buses by 2030
Smart Growth & Compact Development
Transportation and Climate Initiative (TCI)

Building Energy Use
EmPOWER Maryland
Compact Development
State Building Efficiency EO
New Building Codes
Beneficial Electrification

Short-lived Climate Pollutants
HFC regulation (Final Rule)
Methane regulation (Final Rule)
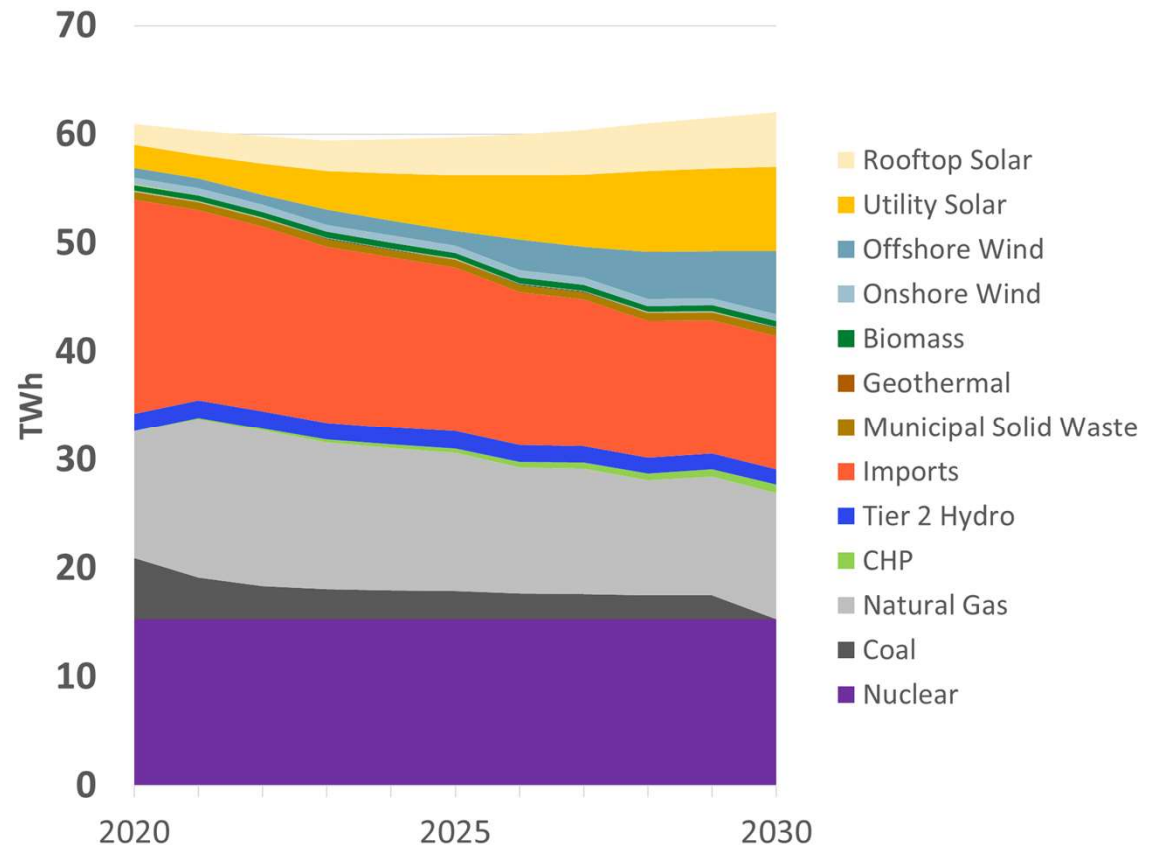Sustainable Materials Mgmt

Carbon Sequestration
Forest Management Programs
Healthy Soils Program

Electricity Supply Programs

Electricity strategy: 100% Clean Electricity by 2040 by building more clean energy and capping emissions from fossil energy.
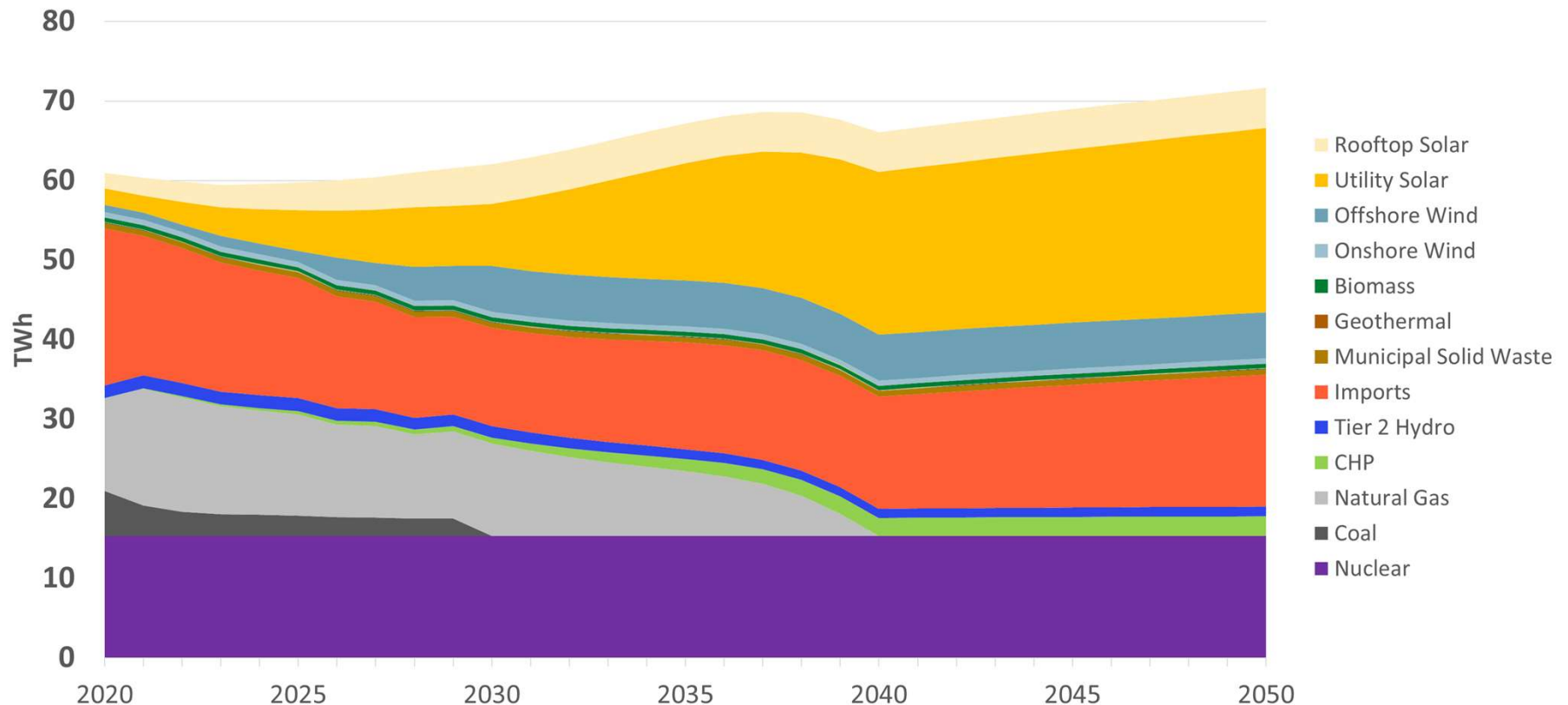
- CARES
  - Bill prepared for 2021 session
  - Builds upon existing RPS; 100% Clean Electricity by 2040
  - Our numbers drawn from analysis by Resources for the Future (RFF), which estimates substantial MD solar builds.

- RGGI
  - Carbon cap on power plants and state investment in clean energy (11 states participate now; 12 soon with PA)
  - Plan proposes long-term cap decline consistent with 100% Clean goal

Maryland electricity generation and imports in GGRA Plan through 2030. CARES and RGGI reduce fossil generation and increase clean & renewable generation.
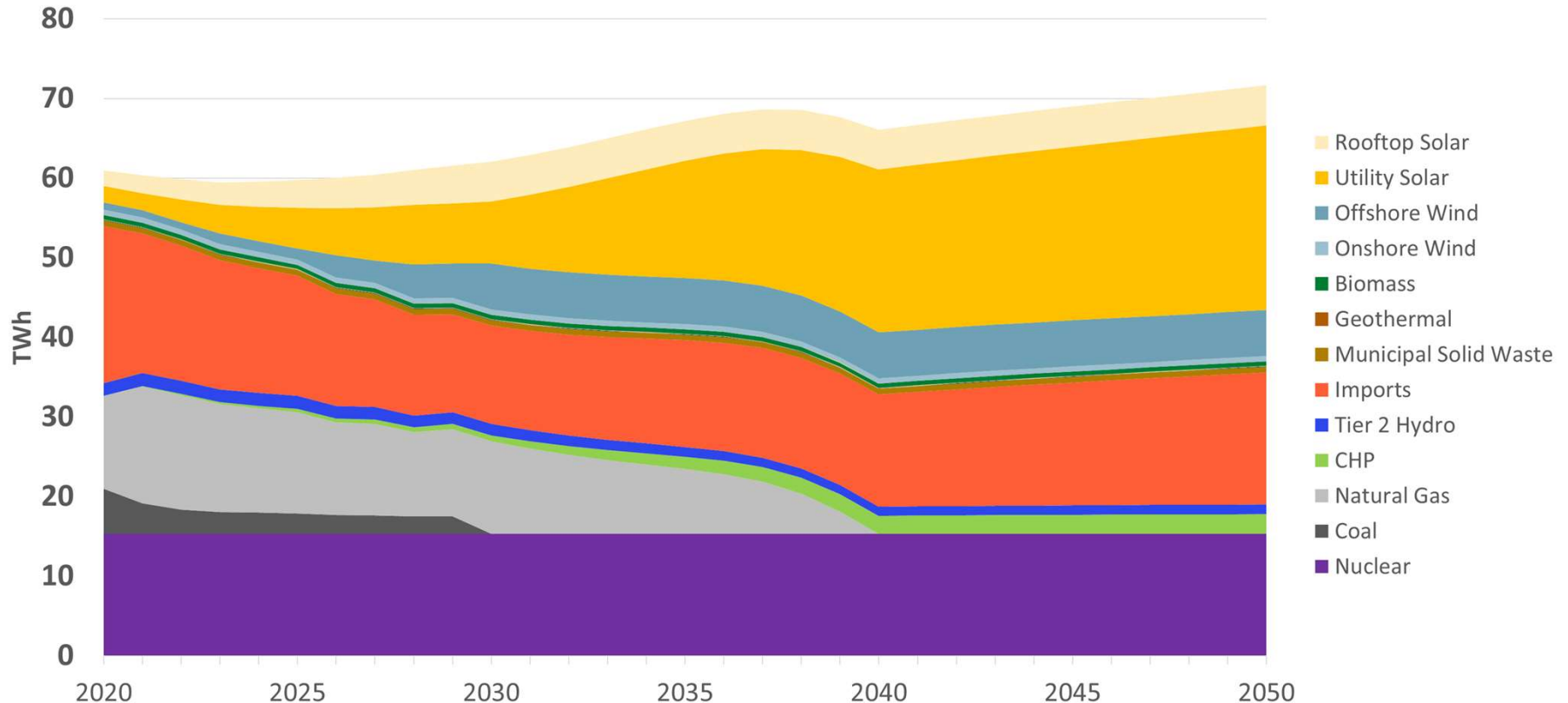**Analysis assumes no new nuclear or carbon capture before 2030**

More on Electricity (1)

- We incorporate sophisticated modeling from RFF and RGGI. Models estimate substantial or total coal retirement by 2030 due to market forces.
- By 2040, 100% Clean Electricity would mean no fossil power plant generation without carbon capture.
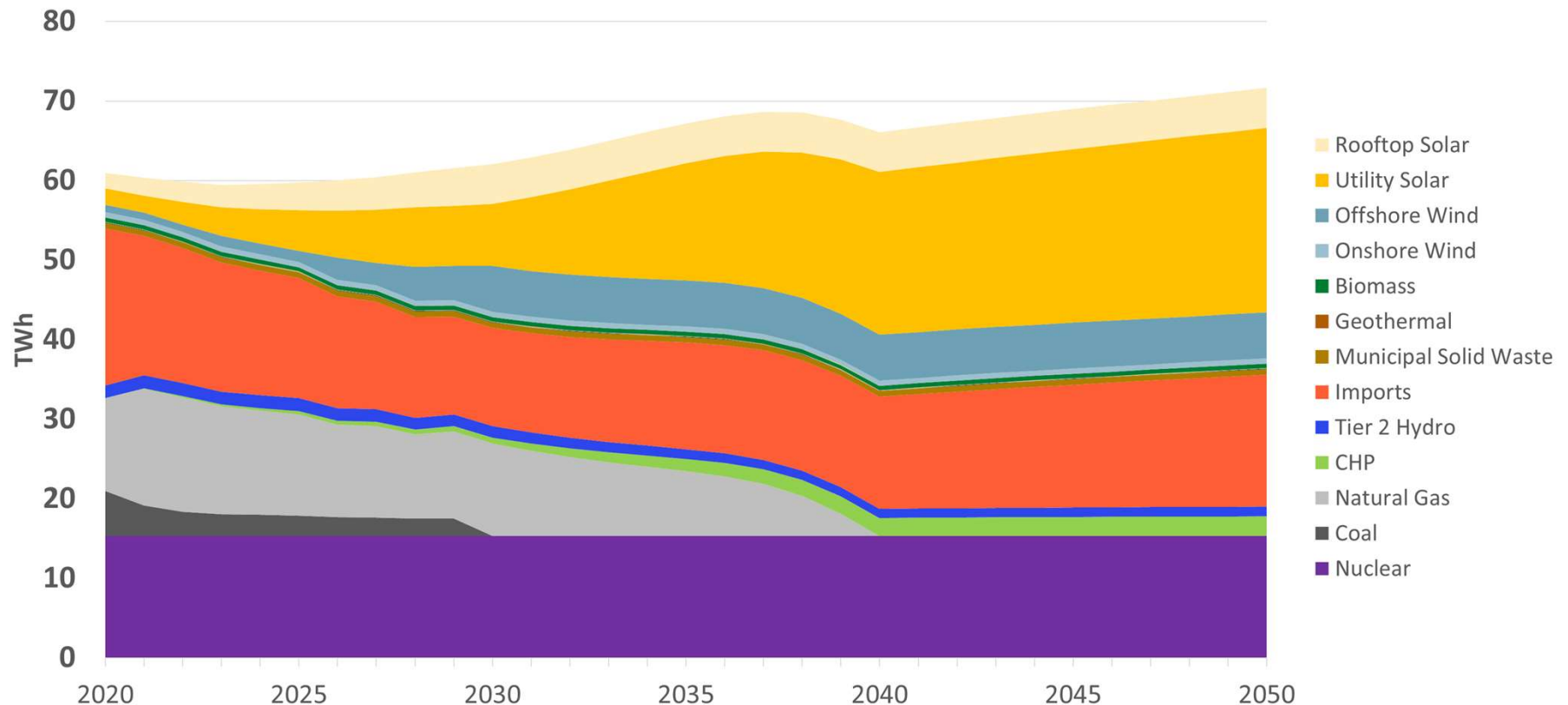
More on Electricity (2)

- The RFF model we looked to to estimate the balance of resources to meet CARES deployed much more solar than CHP, and no carbon capture or new nuclear, **but this is uncertain.**

- CARES would deploy the most cost-effective clean and renewable energy based on how technologies mature.

More on Electricity (3)

- We currently lack detailed electricity dispatch modeling that incorporates energy storage, so we do not have quantitative estimates of the need for battery storage, flexible load, and other measures to accommodate the long-term degree of renewable generation, but those improvements are necessary to deploy beginning in this decade.

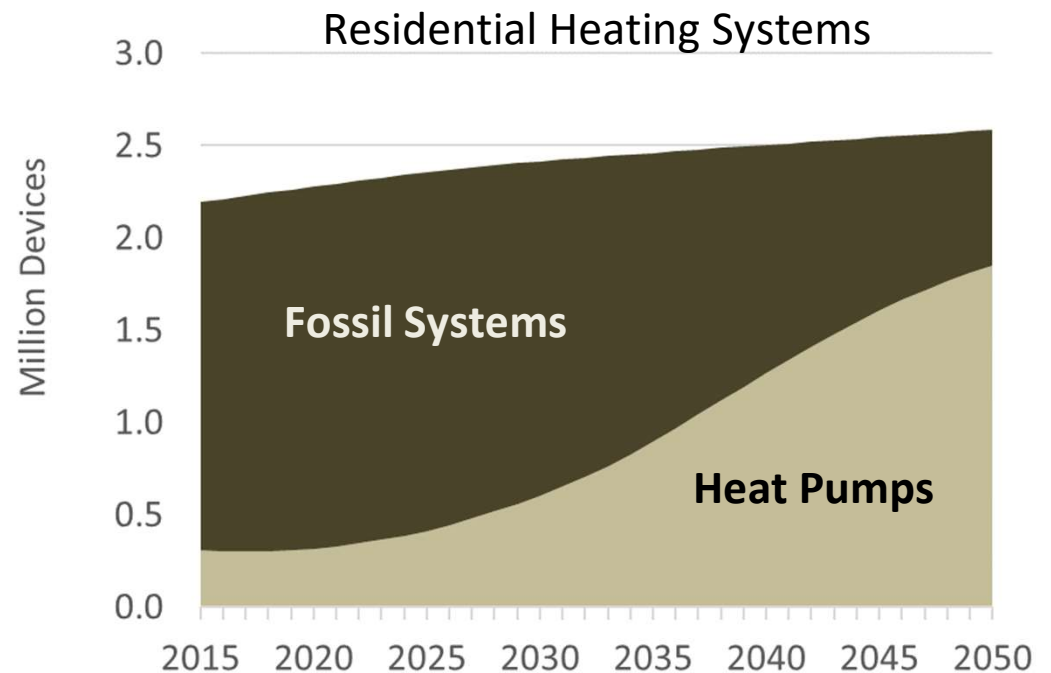(We may have opportunity to incorporate that later)

Buildings Programs

<u>Buildings strategy</u>: use efficiency to counteract growth & convert heating systems to run on increasingly clean electricity.

Efficiency:

- EmPOWER beyond 2023
- Achieve State Building Efficiency Goal
- Achieve Compact Development Goal

Electrification:

- Deploy more efficient electric heat pumps to transition building energy source from fossil fuel to clean electricity.
- MWG to produce buildings plan this year.
- In the meantime, the GGRA Plan incorporates Federal estimates of beneficial electrification in residential and commercial buildings (NREL Electrification Futures Study).

Residential Heating Systems

Million Devices

Fossil Systems

Heat Pumps

3.0 2.5 2.0 1.5 1.0 0.5 0.0

2015 2020 2025 2030 2035 2040 2045 2050

Residential space heating systems, fossil vs. heat pump (air source and ground source), through 2050. Commercial adoption of heat pumps assumed to be much slower.
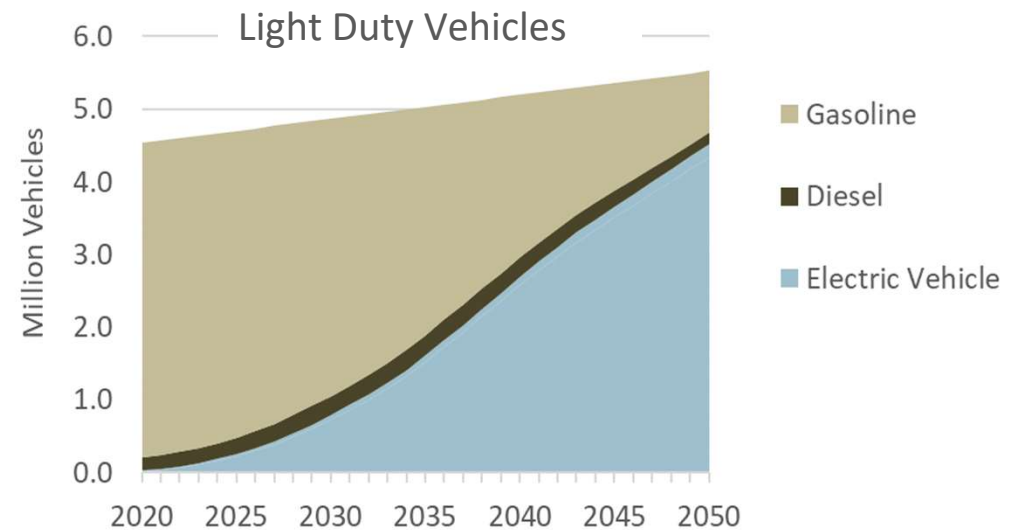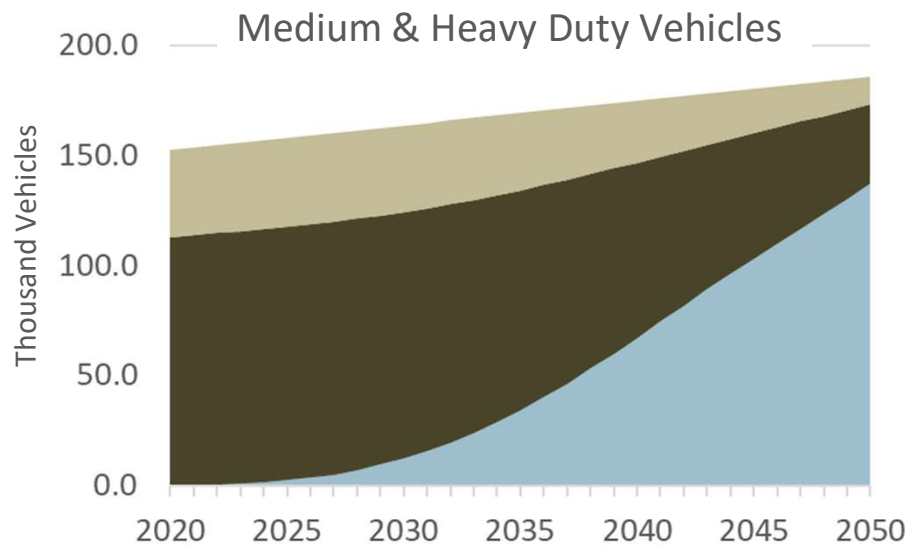
Transportation Programs

Transportation strategy:

Reduce vehicle miles traveled and **deploy electric vehicles** that run on increasingly clean electricity

- Transit Investments
- Intercity Transportation
- Active Transportation (e.g., bike lanes)
- Compact Development

- Clean Cars Program & ZEV mandate
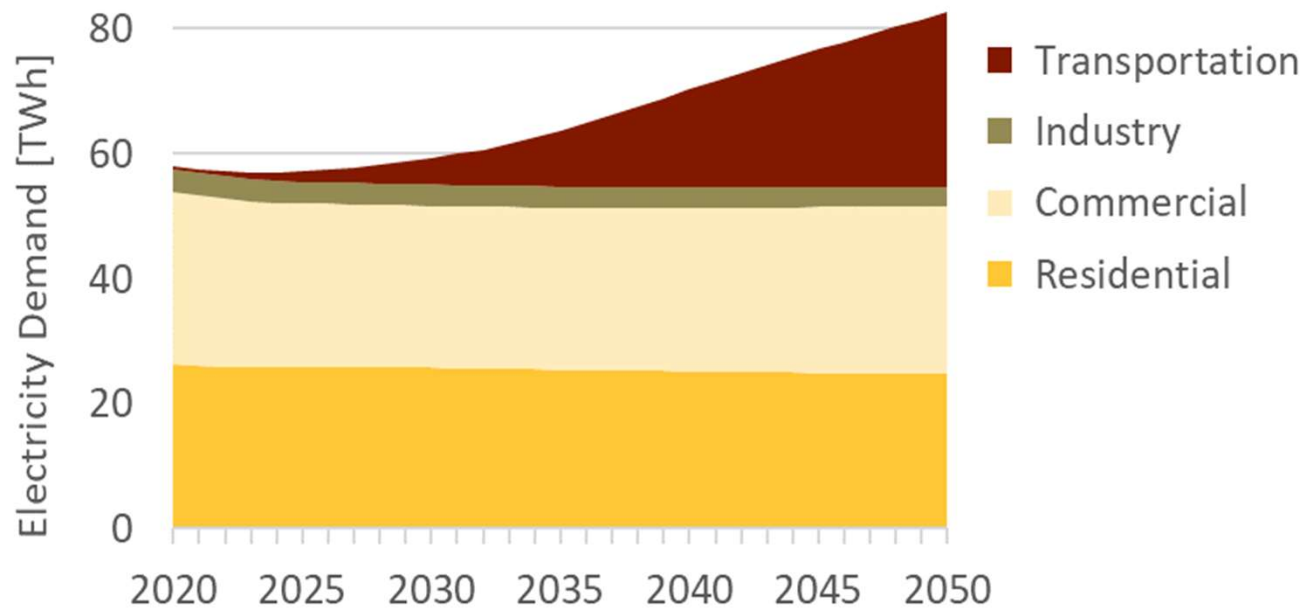- State LDV Fleet Innovation Plan
- 50% ZEV Transit Buses by 2030
- Medium & Heavy Duty ZEV MOU
- Transportation and Climate Initiative (potential)

Medium & Heavy Duty Vehicles

Light Duty Vehicles

Legend:
- Gasoline
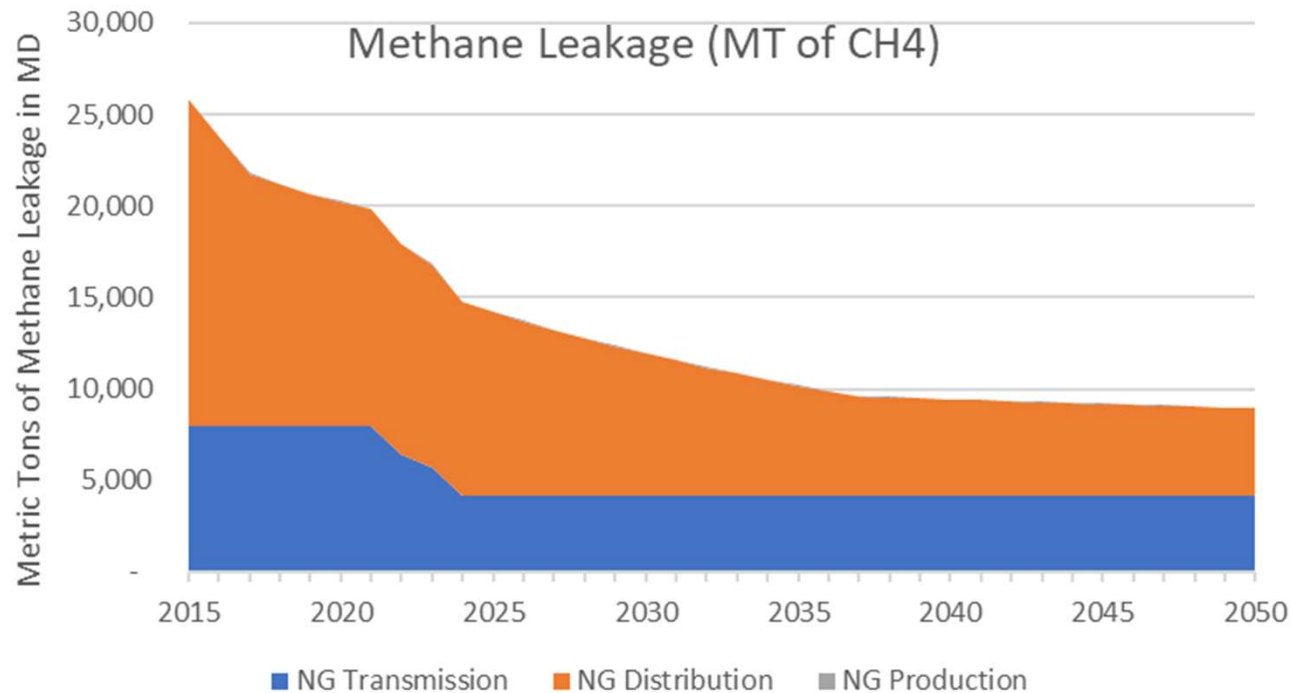- Diesel
- Electric Vehicle

Effects of Electrification

- Overall annual electricity demand in buildings is flat or declining as efficiency counteracts electrification, but changes in timing of demand are important and must be managed.

- Long-term increase in overall electricity demand driven by EVs, but is not material until 2030s.

Methane Leakage from Gas System

- Reductions in <u>Transmission System</u> from MDE regulations published in 2020
- Reductions in <u>Distribution System</u> from utility pipe replacements (STRIDE program + future measures)

Methane Leakage from Gas System (2)

Methane Leakage, 20yr vs 100yr GWP

- Our economywide inventory and GHG projections measure CH4 impacts over 100-year time horizon ("100-yr GWP") per US and international protocols.

- Important to also evaluate impact of short-lived GHGs like CH4 using the 20-year time horizon ("20-yr GWP").

Sequestration Programs

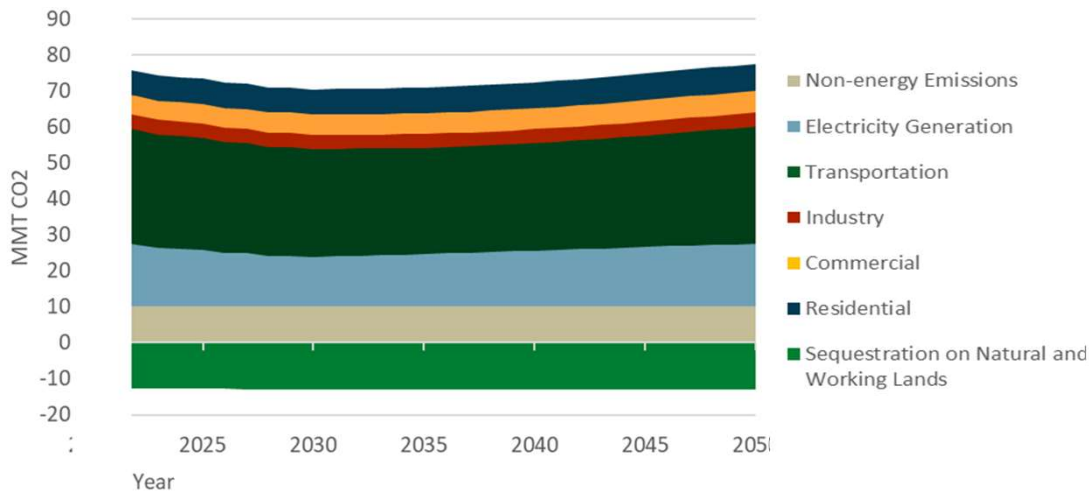Forest management, tree planting, and Healthy Soils programs (DNR & MDA) accelerate carbon sequestration in forests and agricultural soils, adding benefit on top of emission reduction programs.

Reference Case (no additional action)

Latest Scenario

Legend:
- Non-energy Emissions
- Electricity Generation
- Transportation
- Industry
- Commercial
- Residential
- Sequestration on Natural and Working Lands

*Non Energy includes Agriculture, Waste Management, Industrial Process and Fossil Fuel Industry.

Beyond 2030: 2045 and 2050

Legend: 2006 (Baseline), 2020, 2030, 2045

GHG Emissions (MMTCO2e)

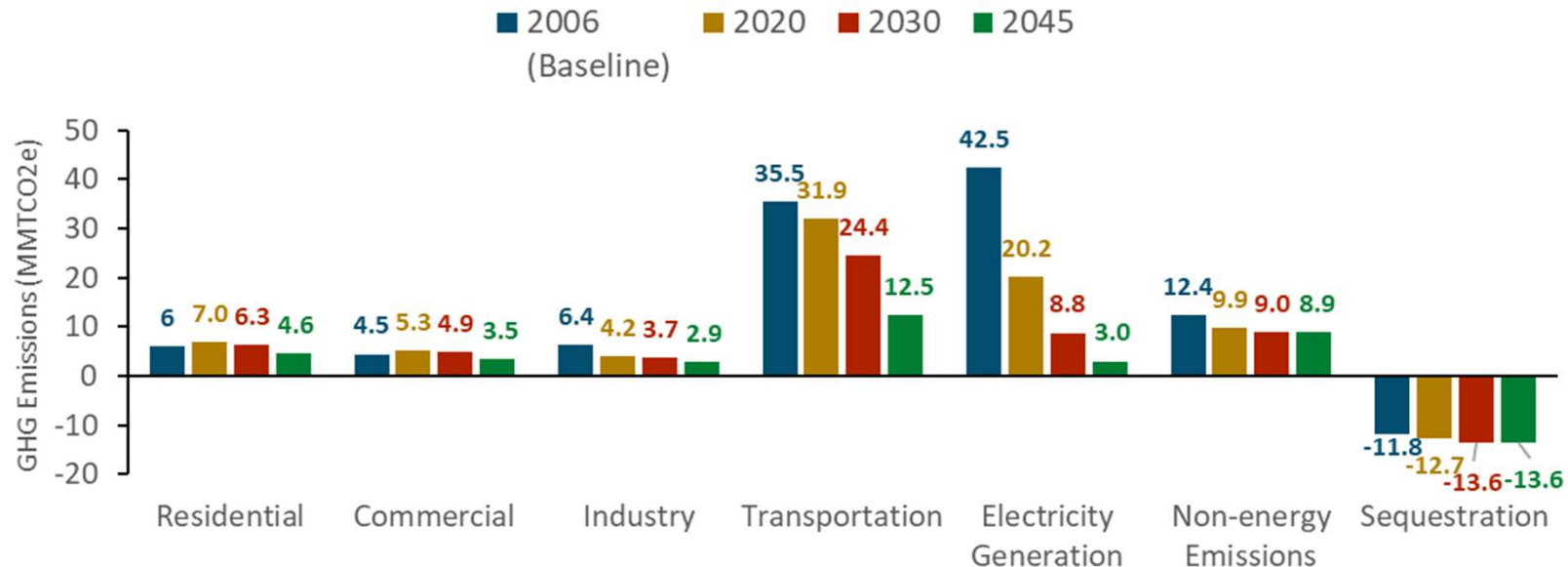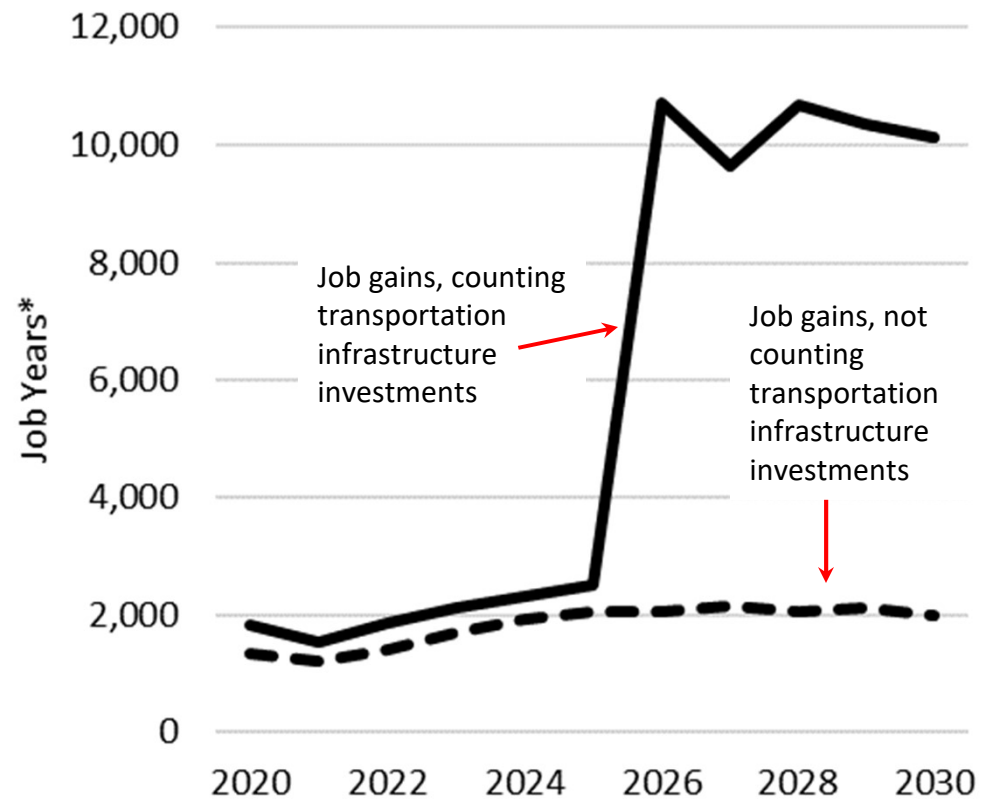| Category	2006	2020	2030	2045
Residential	6	7.0	6.3	4.6
Commercial	4.5	5.3	4.9	3.5
Industry	6.4	4.2	3.7	2.9
Transportation	35.5	31.9	24.4	12.5
Electricity Generation	42.5	20.2	8.8	3.0
Non-energy Emissions	12.4	9.9	9.0	8.9
Sequestration	-11.8	-12.7	-13.6	-13.6

- Additional actions needed beyond 2030 to achieve net-zero GHGs by 2045, including Federal action
- By 2045, additional ~22MMT in reductions needed for net-zero.
- Future measures to deploy: deeper electrification; renewable fuels and carbon capture for remaining combustion sources and process emissions; more sequestration; emerging technology for zero-carbon buildings and vehicles, and direct air capture.
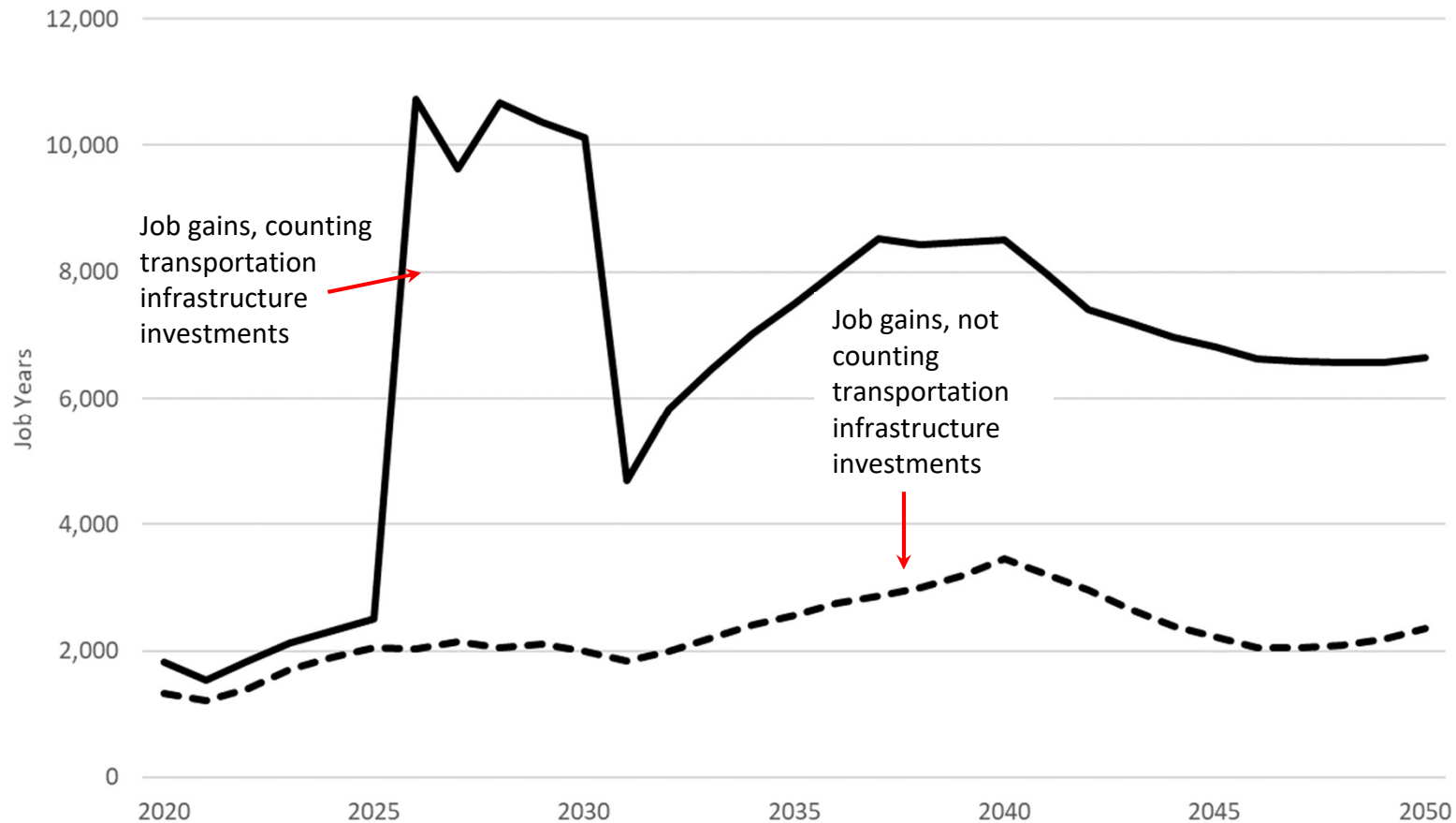
Employment Results

- GGRA requires positive economic impacts.

- The GGRA measures drive substantial job gains.

- Almost all of MD's fossil fuel comes from out of state.

- Investments that reduce fossil fuel consumption have positive impacts for MD's economy.

Large transportation projects drive substantial job gains in the near-term; investments in in-state clean energy and fuel-saving measures provide more modest underlying gains. (Transportation gains dependent on federal funding)

Employment Results (2)

Job gains, counting transportation infrastructure investments

Job gains, not counting transportation infrastructure investments

Large transportation projects drive substantial job gains in the near-term; investments in in-state clean energy and fuel-saving measures provide more modest underlying gains. (Transportation gains dependent on federal funding)
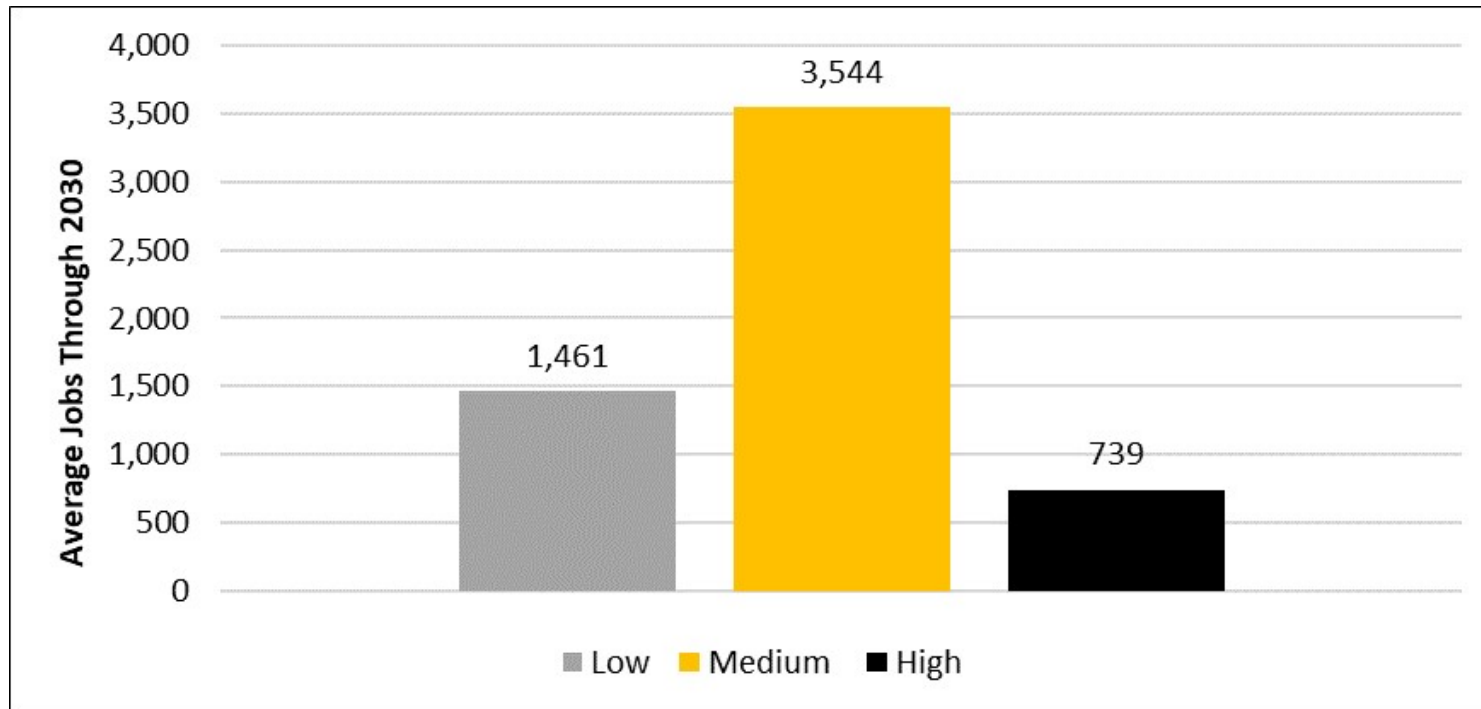
19

Employment Results (3)

Jobs created or sustained by income category (lower, middle, and upper third of income distribution).

- Job gains are concentrated in middle-income categories.
- Towson analysis also explores distribution across geography, education/training requirements, and race/ethnicity.

Economic, Health, and Climate Benefits

The agency scenario achieves the 2030 goal with significant benefit to the state's economy.

MD impact relative to Reference Case	Through 2030	Through 2050
Average job impact*	+ 6,186	+ 6,823
GDP Impact**	+ $ 5.3 billion	+ $ 14.7 billion
Personal Income Impact**	+ $ 4.5 billion	+ $ 16.1 billion
Public Health Benefit (Avoided Mortality)**	+ $ 0.9 to $ 2.1 billion	+ $ 7.5 to $ 17 billion
Climate Change Benefit**	+ $ 3.12 billion	+ $ 27.9 billion

* Average number of job-years created or sustained each year.
** 2018 Dollars, Cumulative, Net Present Value using 3% discount rate.
Climate benefit evaluated using Federal Social Cost of Carbon (2015 Update)

Economic, Health, and Climate Benefits (2)

Impacts are lower than the Draft Plan because some major items have since been implemented; are now "baked in" to reference case and don't count as incremental in our analysis (e.g., 50% RPS, Purple Line)

MD impact relative to Reference Case	Through 2030	Through 2050
Average job impact*	+ 6,186	+ 6,823
GDP Impact**	+ $ 5.3 billion	+ $ 14.7 billion
Personal Income Impact**	+ $ 4.5 billion	+ $ 16.1 billion
Public Health Benefit (Avoided Mortality)**	+ $ 0.9 to $ 2.1 billion	+ $ 7.5 to $ 17 billion
Climate Change Benefit**	+ $ 3.12 billion	+ $ 27.9 billion

* Average number of job-years created or sustained each year.
** 2018 Dollars, Cumulative, Net Present Value using 3% discount rate.
Climate benefit evaluated using Federal Social Cost of Carbon (2015 Update)

Next Steps

1. MDE, agencies, and modelers are finalizing the plan document for publication as soon as possible.

2. Sensitivity analysis exploring upcoming Federal action once we have a clearer picture of incoming administration's plan.

3. Follow-up analysis of individual program contributions in the coming months.

4. Some underlying planning processes continuing this year, including Buildings Plan (MWG) and Medium/Heavy Duty ZEV Action Plan (Agencies, ZEEVIC, & Multistate ZEV Task Force).

5. Mid-course progress report due in 2022.

Contact

Chris Hoagland

Climate Change Program Manager

Maryland Department of the Environment

chris.hoagland@maryland.gov

Follow us

f

@ClimateChangeMaryland